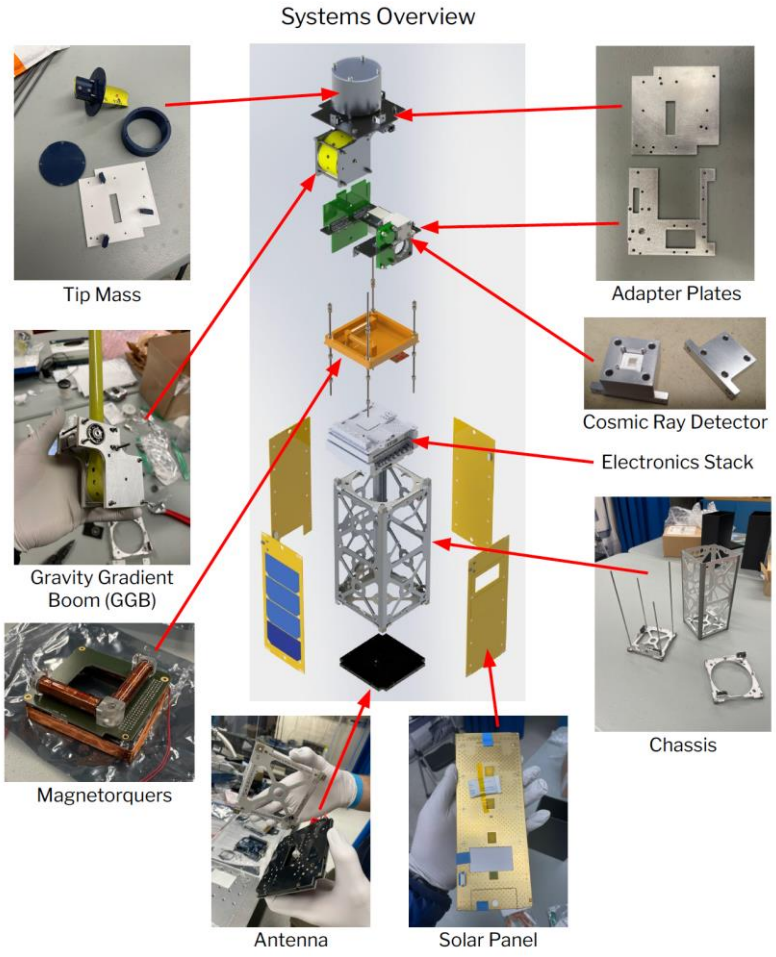
BLAST Satellite Technical Description

The overall goal of the BLAST mission is to operate a custom-built scintillator cosmic ray detector in low Earth orbit as well as to demonstrate a gravity gradient boom as a passive attitude stabilization approach.

The satellite will be launched as a secondary payload aboard SpaceX Mission 30, from Cape Canaveral, no earlier than March 4, 2024. It will be inserted into an orbit at 424 km apogee and 408 km perigee, on an inclination from the equator of 51.6 degrees. Transmission will begin 35 minutes after deploy. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs about 10 months after launch. See the Orbital Debris Assessment Report for details.

The spacecraft is a single unit with the dimensions of 2 stacked 10 cm X 10 cm X 10 cm CubeSat modules (giving an overall dimension of 10 cm X 10 cm X 20 cm.) The total mass is about 3.1 Kg. See the ODAR for details.

Figure 1 BLAST System Overview



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The satellite contains the following systems:

On-board Computer (OBC): Commercial off-the-shelf on-board computer, runs custom software to control and monitor all other satellite subsystems, execute mission progression, control radio communications, aggregate scientific and diagnostic data, and manage power.

Communications System (COMMS): EnduroSat Type II UHF transceiver, and EnduroSat Type III turnstile antenna, communicating with the ground station at Yale University. COMMS supports telecommand and downlink of scientific data and telemetry. All transmissions from the sat may be terminated by telecommand from the ground station.

Power: four solar panels and a commercial off-the-shelf 2-cell rechargeable Li-Po battery system with maximum power output 10W, powers all other satellite subsytems.

Active Attitude Determination and Control System (ADCS): includes magnetometer, digital sun sensor, and 3-axis magnetorquer, all controlled by on-board computer. Sat detumbles by firing magnetorquers so as to counteract the change in the local magnetic field vector. Attitude is monitored by combining sun sensor, magnetometer, and location data.

Gravity Gradient Boom (GGB): A passive attitude stabilization system developed by the Yale team, that maintains the sat's long axis perpendicular to Earth's surface, works by extending a Tip Mass (filled with lead shot) away from the sat and moving the Center of Gravity away from the Center of Mass, thus creating an effective pendulum where the differential gravitational force induces a restoring torque on the system.

Cosmic Ray Detector (CRD): Custom-built scintillator-based detector to measure flux of solar protons and extragalactic cosmic rays through the satellite. Scintillation flashes will be detected and amplified by a silicon photomultiplier, and pulse height analysis performed with a custom PCB. Count data will then be read off a bank of digital counter chips to be downlinked.